Data Transmission in the Medical Field with the Implementation of Wireless Body Area Network

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Abstract

Wireless Body Area Network (WBAN) is one of the most important technologies involved in the field of health care. Due to the great development in their applications WBAN has received a great attention in the field of physical condition, health check, entertainment services and the fields related to medical. WBAN is also as like the same process of Wireless Sensor Network. The WBAN technology is to arrange them in the medical system to swap wires with the help of sensor nodes entrenched into the patient's body or placed in the region of the patient body. Not only it gives more consoles to the patient, but also the patient can get treatment in distance mode by the healthcare system. It is very useful to the aged citizens or people with any disability to offer medical talent at home or in any critical situation. WBAN has a huge area for scientists in recent years. In this paper, various existing approaches of WBAN were explained and discussed about the scope for further exploration in this medical field. The literature survey represents that the proposed architecture can be further adapted to plan more unswerving clarifications for WBAN systems.

Keywords: Eavesdropping, Healthcare, Interference, WBAN

1. Introduction

Medical field has no more development in its medical devices and healthcare systems in recent years ago. Due to its lack of facility, patients put their lives on risk in emergency condition. Medical facilities were provided with full of wires and it was very complex to handle it for patient. Wireless body area network which is able to change the landscape of the medical systems and currently medical field is developing in its way of delivery[1]. Due to its diversity of application such as health check, hospitality, and hobby service, WBAN has received great attention[2]. Different medical equipment's as listed below are cardiograph for electro analysis, Insulin grapier for diabetes checker, temperature and beat sensors, all have been also moved to WBAN technology. WBAN technology that decreases the problem of wires in the healthcare system and increases the comfort (security) of the patient and provides ability for healthcare system to monitor patient distantly[3]. A Goal of Body area network is health-care system that guarantees the continuous, reliable gathering and objective analysis of physiological and behavioral aspects of a patient, and delivers this information to physicians. In WBAN sensor nodes are positioned on the human body or placed on everyday wear. In WBAN the benefits at one hand, there are also various issues like intrusion and data losing that Body area network should solve on other side. Energy efficiency related issues can be resolved by various MAC layer techniques. Considering the human body as a communication channel is more energy efficient and reliable in medical field[4].

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2. Related Work

Literature survey of the various Wireless BAN approaches are described as follows:

Thamilarasu et al.[1] proposed an autonomous mobile agent primarily based intrusion detection design to deal with security in wireless body area networks. In this paper intrusion detecting in WBAN by mobile agent migration and cooperative performance was analyzed. Every node in the WBAN behaves as computing node. Here, a various mobile agents based interruption finding system is established so, learning and decision generating is distributed among total different nodes within network.

Lee et al.[2] presents a printed antenna which was double banded with metal back-cover for WBAN. Its operation with 2.54 gigahertz and 5.6 gigahertz was used for electrical, technical and health care groups. The performance of the proposed antenna flatbed body is used to analyze adore physical body.

Rahman et al.[3] proposes two sections namely:

2.1 Section 1

The safety measures of Wireless BAN system are charged by means of Assessment with Practical Impact. This Assessment value calculates the WBAN sanctuary threats chiefly based on 3 parameters such as Confidentiality, Integrity and availability.

2.2 Section 2

By implementing Inputs from the Assessment value, Practical Impact develops forensics eagerness building for WBAN. This planning for WBAN can make easy to avoid WBAN security threats and become conscious out of the attacker.

Kim et al.[5] analyzes MAC protocol that applies on the delay limitation to MAC Protocol in medical signal observance to scale back the time delay and packet loss in TDMA primarily based CSMA/CA surroundings. The Proposed MAC Protocol's superintendent frame has same sort and structure as Bio MAC protocol super frame. The proposed Method's aim is to decrease delay therefore it is named DTD-MAC (Decrease of Transmission Delay). In this paper WBSN surroundings is established as star and computer simulation is conducted in static environment within which range of node devices doesn't amendment. DTD-MAC Protocol is efficient additional than Bio-MAC.

Froehle et al.[6] gives plan concerning analysis on WBAN for area that provides safety of future astronaut throughout area of Exploration, Advance Health Industry and Technology. In the spacesuit health watching system, Module of Bluetooth and Human Sensors should be enforced on the inner aspect of pressure suit with efficiency live important signal and to shield instrumentation from worst surroundings and antenna must be connected to the Bluetooth. In the simulation, Perfect Conductor with Electric analyzer is mainly used because the ground plane material that develops the reported output which is having space of air downside in pressure suit therefore to down this gap a ground style was enforced.

Kim et al.[7] proposed a Multi hop WBAN construction theme that has 3 operations:

- The topology setup.
- Mobility hold up.
- Broadcast efficiency improvement.

Existing schemes work on 1-hop based star network that is helpful just for short vary network by other side multi hop process have immeasurable benefits. Table 1 contains the information about the comparison of different types of networks.

Table 1. Comparison of Wireless Network Types

Type	Coverage	Performance	Standards	Applications
Wire-less PAN	Within reach of a person	Moderate	Wireless PAN Within spread of a person Moderate Bluetooth, IEEE 802.15, and IrDA Cable replacement for peripherals	Cable replacement for peripherals
Wire-less LAN	Within a building or campus	High	IEEE 802.11, Wi-Fi, and HyperLAN	Mobile delay of wired networks
Wire-less MAN	Within a city	High	IEEE 802.16, and WIMAX	Secure wireless between homes and businesses and the Internet
Wire -less WAN	Universal	Small	Cellular up to 3G	Mobile communicate to the Internet from open-air areas

3. General Process of WBAN

Wireless body area networks (WBANs) are emerging as one of the most recent forms of Wireless Sensor Networks. In WBANs, sensor nodes amass human data and send out it to the sink node. The transmission of physiological data to the sink node in excess of a mobile route becomes a very intimidating chore for sensors due to their limited battery power. Substitute of critical sensor nodes is a main dispute in such cases. Data collected from the human body using CCU (Coronary Care Unit) box and then how it is transferred to the web-based internet to generate the report is explained in Figure 1. In each and every parameter initialization the server is also initializing (giving the ranges) the minimum energy consumption by increasing the transformation speed. Throughput is maximized for the purpose of avoiding the dropping of data.
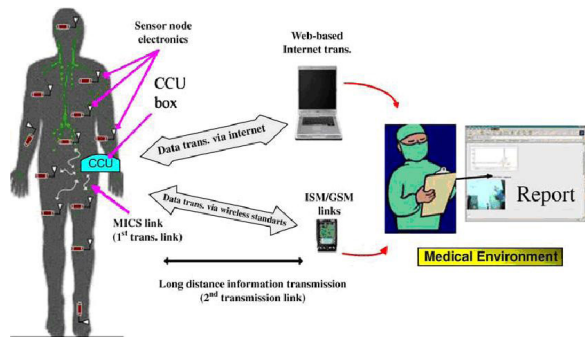

Figure 1. Coronary Care Unit.

4. Problem Identification

The proposed problem deals with real-time medical information gathering obtained from different sensors with secure data communication and low power consumption.

During transformation of data from sensor nodes, some problems are sorted out from the existing system

- Packets dropping
- Residual energy consumption

These identified problems are solved with the help of implementing a new technique named transferring ECG data using WBAN for Optimized Throughput is discussed in the proposed work.

5. Process of Transfering ECG Data using WBAN in Health Care

5.1 Level 1

The nodes are placed in and on the human body.

5.2 Level 2

It includes a BAN Networks Controller (BNC) that collects patient's very important data from the BNs and sharing of information with the bottom posting.

5.3 Level 3

Base-stations maintain the patient's personal and medical details to provide relevant recommendation is given in Figure 2.
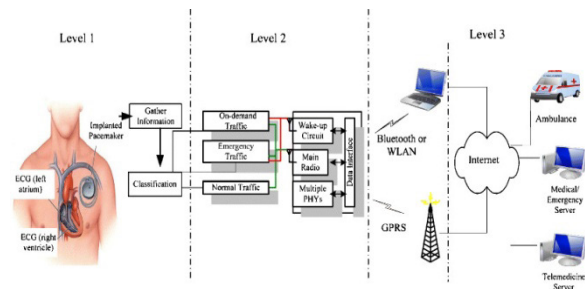

Figure 2. Health Care in WBAN.

During this process the problems like packets dropping and residual energy consumption are solved at the maximum in the proposed work.

6. Proposed Work

Parameter settings are made in this new algorithm which is performed in the initial parameter settings phase. Data are not properly received to sink and delay of time for transmission is so high. But, now by implementing this new algorithm,

$$X_{con_{source}} = \begin{cases} Value_0^1 & \text{1 if the sensor can establish link with the destination} \\ & \text{0 otherwise} \end{cases}$$

the analyzer rectifies the proper delivery of data.
Parameter for Throughput Maximization:

$$Min \sum_{con_{source} \in N} E_{final}(i) = \sum_{con_{source},con_{\sin k} \in N} E_{con_{source}} + E_{con_{\sin k}}$$

$$Max \sum_{con_{sink} \in N} dist^t_{con_{source}}$$

Using the above formulae, the throughput speed was maximized and so that the delivery will be fastened.

7. Results and Discussions

7.1 Packets Received in Base

Figure 3 shows the difference between the base and proposed work for receiving of data from source to

destination. Now by implementing this new algorithm the loss of data has been decreased.

Figure 3. Packets Received at Sink in Base and Proposed Work

7.2 Delay in Base and Proposed Work

Figure 4 shows the difference between the base and proposed work for delay of data transmission from source to destination. Now by implementing this new algorithm the time taken for transmission is increased as shown above.
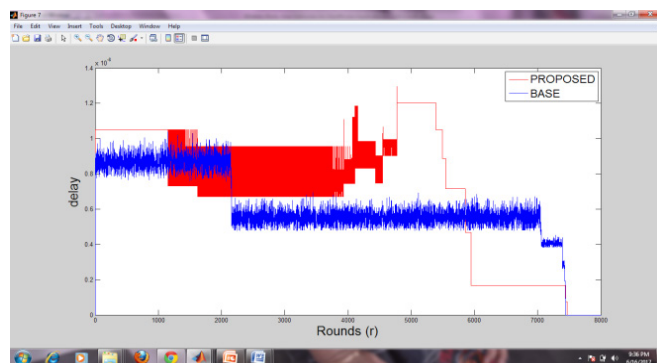

Figure 4. Delay in Base

8. Conclusion

At the current stage, the main process of this work is to construct a protocol which will help the researcher to satisfy the important requisites of WBANs in the field of health care process.

Optimal use of network energy increases the network lifetime was given in the proposed work. Optimized throughout deploys a hierarchical multihop method which instigates the clustering in the routing. The proposed algorithm with two primary aspects: energy-awareness and node coverage preservation mechanisms were discussed in this work. Data transmission in the medical field with the implementation of wireless body area network utilizes the metrics of the link credit (LC) and signal strength (SS) to assess the node in-between distance.

9. Future Enhancement

Future work can help in handling the actual battery level status in diverse platform with battery sizes and harvesting of power methods. Investigational setup can also be handled in future.

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